



A New Understanding of Venus' Tail Rays from *Parker Solar Probe*

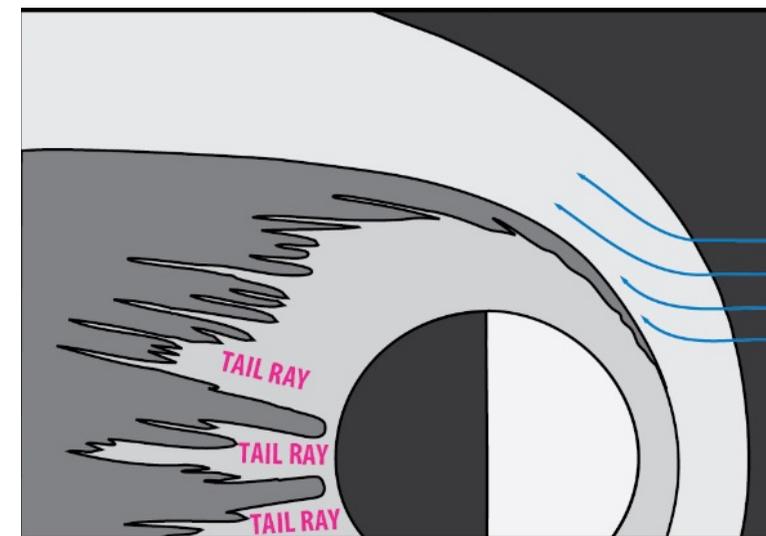


Understanding how Venus loses water to space is paramount to understanding how wet Venus once was and whether it was habitable. NASA's Pioneer Venus Orbiter (PVO) mission discovered Venus has comet-like “tail rays” caused by the interaction of its atmosphere with the solar wind and the Sun’s magnetic field. These may be a major cause of water loss.

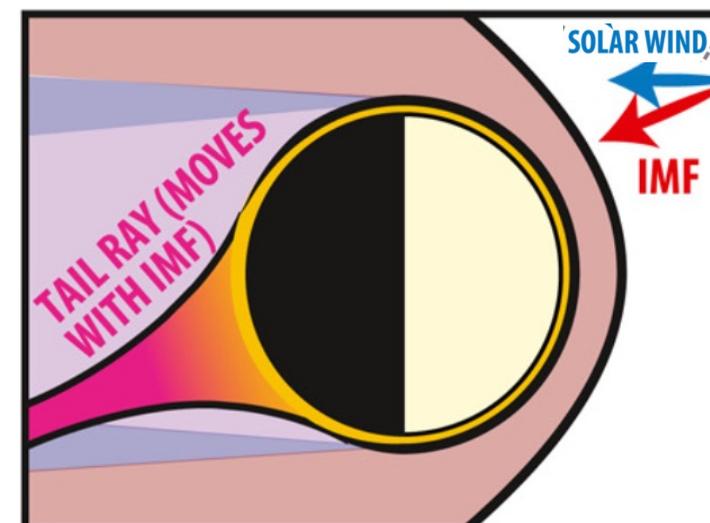
On February 20, 2021, NASA's Parker Solar Probe made its fourth close flyby of Venus. Parker encountered a plume with all the properties of a Venusian tail ray. PVO did not tell us how far the tail rays extend from Venus, or if there are multiple rays or just one. Parker measurements confirm the predictions of recent simulations which predict a single complex tail ray extending from the nightside of Venus to an altitude equivalent to the radius of the planet (>6,000 km).

These observations revolutionize our understanding of the Venusian magnetosphere, and future research into the tail rays may lead to a better understanding of how Venus lost its oceans. A recent study suggests that the tail rays are caused by an electrical field that is generated by the atmosphere of Venus. Understanding such electric fields is currently a hot topic, with NASA’s *Endurance* rocket mission launching in 2022 to attempt to make the first measurement of Earth’s electric field.

Collinson, Glyn (CUA/673), Ramstad, R. (LASP), Frahm, R. (SwRI), Wilson III, Lynn (672), Xu, S. (UC Berkeley), Whittlesey, P. (UC Berkeley), Brecht, S.H. (Bay Area Research Corp.), and Ledvina, S., 2022: Geophysical Research Letters <https://doi.org/10.1029/2021GL096485>



1982 PVO picture of the structure of the Venusian tail



2021 Parker picture of the structure of the Venusian tail